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The Simulation of Dust Storm in China

Song Zhenxin, National Meteorological Centre, Beijing, 100081

Abstract

Wind erosion occurs in many arid, semiarid and agricultural areas of the world. The desert areas of China, which occupy approximately 13% of China's total surface area, are major sources of Asian dust. The major wind-erosion areas are the sandy lands in western and northwestern China together with the extensive region regions of The Gobi desert in northern and northeastern China, especially along the basin of the Yellow River. In this paper, we analysis the geographical distribution of duststorm which was simulated by using an integrated numerical modeling system.

The purpose of simulation on dust storm is to produce quantitative predictions of wind erosion on scales from paddock to global. Our integrated wind erosion modeling system coupled the following three major components: (1) An atmospheric-prediction model, together with a land-surface model; (2) a wind-erosion model and (3)a geographic information database. The atmospheric model provides the necessary input data for the wind erosion scheme, including wind speed and precipitation. It also provide input data for the land-surface model which produces predictions for soil moisture. Dust transport and deposition are also considered in the atmospheric model. The wind-erosion model predicts streamwise saltation and dust emission rate for given atmospheric, soil and land surface conditions. The geographic information database provides spatially distributed parameters, such as soil type and vegetation coverage, for the atmospheric, land surface and wind erosion models.

Dust storms in China occur mainly in spring and winter, but most frequently in April. In spring, surface soils frozen in the previous winter become especially loose, creating a favorable condition for wind erosion. As a example, the severe dust storms of 20 March and 6-7 April 2002 were simulated. The results show the integrated model system can simulated the main characteristics of the two cases. Wind erosion model produced estimates of wind erosion intensity and patterns which are in reasonable agreement with observation. An integrated wind-erosion modeling system offers the possibility of determining wind erosion patterns on broad scales with high spatial resolution, as well as dust transport and deposition.